MANURE.

a green or oilseed crop. If it seems to want it the land is manured before the third crop is grown. Black and good brown soils are manured once in three, four, or five years. They are naturally rich, and their vigour is renewed by the upper soil being always washed into cracks and the subsoil coming up for tillage. Red and poor brown soils are manured every second year and in some cases, if the husbandmen can afford it, every year. Sugarcane, rice, Indian millet, chillies, and *rági* want manure every year; *sáve* Panicum miliare, castor-oil, and *uddu* Phaseolus mungo want manure once in three years. On account of the labour and cost of carting the manure, fields more than a mile from the village are not manured oftener than once in three or four years. There are four methods of enriching the soil, the chief of which is mixed manure. This consists of cattle droppings, ashes, stubble, the shells of betelnuts, urine, and every form of rubbish which can be gathered. All this is stored in a pit near or in the husbandman's yard. The manure in the pit is occasionally covered by a thin layer of earth or house sweepings by which the volatile properties are kept from passing into the air. Some time before sowing, the manure is carted to the fields, piled in small heaps, spread on the field, and ploughed into the soil. In sowing Indian millet and other grains the poorer husbandmen mix the manure with the seed. As each husbandman has his manure pit, manure is not sold. An acre of garden land wants ten cartloads of manure of the nominal value of 5*s.* (Rs. 2½), and an acre of rice or dry-crop land wants four cartloads nominally worth 2*s.* (Re. 1). The second way of manuring is by having the stubble, the cotton leaves, and the weeds eaten by sheep or goats. These animals are known to leave their droppings on the ground the moment their rest is disturbed. The husbandmen contract with the shepherd that the sheep or goats shall not be allowed to rest more than an hour or two in one place, but be moved from time to time in the field. The urine and droppings are thus evenly spread over the whole field. When the finer-grained crops such as *sáve* Panicum miliare, and *yellu* Sesamum indicum are about to be sown the stubble is gathered in heaps and burnt on the field. The fourth way of enriching the soil is by green manuring. Black sesamum or *guryellu* is sown in late May or early June and is allowed to grow for three months when it flowers. It is then ploughed in and destroyed by the heavy hoe or *kunti*. This is considered sufficient manure for two years. In some places pond silt is spread on the fields, but silt is not so enriching as the other manures.

CHANGE.

A two years' change of crop is held to be relief enough to the soil. In black soils cotton and Indian millet, as a rule, are sown alternately. In red soils Indian millet is followed by Italian millet, *rági, sáve,* chillies, or castor-oil, that is the change is from grain to green crops or from grain to oil-seeds. Oil-seeds are often used as a relief to the usual change of grain and green crops. The same crop is seldom sown in the same land for two successive years. The chief exception to this rule is that grain may be sown in the same field for several years without a change if care is taken that a late crop succeeds an early crop. Thus the early millet may be succeeded

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CHANGE.

by the late *navani* Panicum italicum or wheat. Green and oil crop may also be grown for several years in succession if the crop is changed, thus gram and safflower may come after cotton or black sesamum. As these are all late crops the soil has the benefit of a whole year during which it rests through the hot season and the early rains to receive which it is turned more or less deeply. With an average supply of rain good black soil yields a second crop. In the plain to get a second crop the early crop must be white sesamum. This is reaped in the end of August, when the soil is thoroughly ploughed or otherwise turned, and wheat or gram with an occasional row of safflower, linseed, or castor-oil are sown. After these the next crop is generally one of the early millets for which the soil is manured. There are therefore three modes of changing the crop: A change of grain with green crops or oil plants, a change of oil plants with green crops, and a change of early with late crops.

FIELD TOOLS.

Dhárwár field tools are like those used in the neighbouring districts of Belgaum and Bijápur. A detailed description is given in the Belgaum Statistical Account. The chief field tools are the heavy plough or *negali* (K.), the light plough or *ranti* (K.), the large hoe or *kunti* (K.), the leveller or *korudu* (K.), the seed drill or *kurgi* (K.), the grubber or *yadi kunti* (K.), and the pickaxe or *báigudli* (K.). Both the heavy or *negali* (K.) plough and the light or *ranti* (K.) plough consist of a thick log of wood shaped by the village carpenter, with its lower end curving forward at an obtuse angle from the main block. The share, which is an iron blade, one and a half feet long by three to four inches broad and four to twelve pounds in weight, is let into a socket and fixed by a movable iron ring to the wooden point beyond which it juts about six inches. The handle is fixed to the block by a thick rope passed along the beam and tied to the yoke, so that the strain of draught braces the different parts of the plough. The *negali* is a large, heavy, deep-cutting plough, and is worked by two to six pairs of bullocks. Besides the ploughman, who is seldom able to keep the plough in anything like a straight line, it requires one to two men to drive the team. It costs £1 4*s.* to £1 12*s.* (Rs. 12-16) and as a rule is owned only by wealthy landholders who often lend it to their poorer neighbours. Except when the land is in very bad order the *negali* is never used. It is very effective in loosening stiff land and in uprooting weeds. The *ranti* (K.) or light plough is of exactly the same make as the heavy plough. The only piece of iron about it is a narrow bar about nine inches long which serves the purpose of a share. It is worked by one pair of bullocks and costs about 4*s.* (Rs. 2). The ploughman manages it by himself as the reins of the bullocks come to the handle of the plough. In red and black soils the small plough is used before sowing to turn the soil; but, except cotton fields, good black soil often yields for several years without wanting even the small plough. The large hoe or *kunti* (K.) is a rude tool. The chief part is a stout slightly crescent-shaped blade of iron about three feet long and four to five inches broad, fastened in stout timbers with its cutting edge turned forward. The timbers are secured slopingly in a heavy beam of wood five feet long and one foot broad. The beam is joined to the yoke by two lighter pieces of wood and

from the upper surface of the beam rises the handle to which one end of a rope is tied and the rope is wound once round the lighter timbers in the middle, and is taken to the yoke and tied there. The large hoe costs about 10*s.* (Rs. 5) and is worked by four bullocks. To add weight a couple of boys generally sit on the beam, on each side of the handle, and are ready to clear stones stubble and other rubbish that may choke the hoe. Except in rice lands, in all lands where a plough is used before sowing, the large hoe or *kunti* follows the plough, breaks the larger clods, gathers the roots of weeds and of the last crop, and thoroughly loosens the soil. In rich black soil, where for several years no ploughing is required before sowing, the large hoe is used to turn the soil. As land stiff and full of weeds requires the *negali* or heavy plough, so weedy stiff land requires a larger deep-cutting hoe called *mági kunti* (K.). A third small light hoe called *ballesal kunti*, is, in all soils, used after the *kunti* to level the surface and to cover seed sown by the seed-drill or *kurgi*. Besides the different hoes, a log called the *korudo* or leveller is used for breaking clods and smoothing the surface. The leveller is the log of a tree trunk split down the middle, scooped out and smoothed outside, and with two wooden pieces driven through it, on which the drag ropes and yoke are tied. When at work the driver stands on the leveller to give it weight. The seed-drill or *kurgi* is of two kinds, one for sowing grain and the other for sowing cotton. It consists of wooden beam with three to four wooden bills standing out at equal distances and armed with small iron tongues to make drills. To each of these bills is fixed a bamboo tube whose upper end is joined to a hole in the bottom of a wooden cup which has as many diverging holes as there are tubes. It costs about 4*s.* (Rs. 2) and is worked by a pair of bullocks yoked in the same manner as in the light plough or the light hoe. The driver fills the cup with seed. In some villages the seed-drill has only three bills, which are wider apart than the four bills. When mixed grains are to be sown in one of the drills the driver plugs the cup hole for that drill and the seed is sown by a man who walks behind, and, from a cloth-ful tied at his waist, drops seeds through a hollow bamboo called *bukku* which is tied to the seed-drill. The cotton seed drill is made on the same plan as the grain-sowing *kurgi*. It has only two bills eighteen inches apart and has no cups with holes. It is worked by a pair of bullocks yoked in the same way as in the grain drill. At the back of the beam of the seed-drill are tied by ropes two hollow bamboos or *bukkus*, which are kept in furrows drilled by the iron tongues of the bills, by two sowers, who from a clothful of seed at their waist drop the seed through them. The grubber or *yadi kunti* is used to clear grass and weeds between the rows of young crops. It also earths up the soil at the roots of young cotton plants. It consists of a beam two and a quarter feet long by six inches broad with two stays like the harrow. In the lower end of each stay a blade of iron is fixed horizontally to the beam. Two beams are generally worked by one pair of bullocks; and sometimes one pair of bullocks works three and in rare cases even four beams. Each beam is joined to the yoke by two stout bamboos, each fixed to the beam over each stay, and is guided by one man. It costs

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2*s.* 6*d.* (Rs. 1¼). The pickaxe or *báigudli* has one end pointed and the other end bladed into a sharp adze. It is most effective in cutting and uprooting grass and other weeds after the land has been ploughed. It costs about 10½*d.* (7 *as.*). Besides these field tools there are a weeding hook or *kurchegi* worth about 9*d.* (6 *as.*), an axe or *kudli* worth 2*s.* (Re. 1), a sickle or *kudgolu* worth about 2*s.* (Re. 1), a saw-sickle also called *kudgolu* worth 1*s.* to 2*s.* (Re. ½-1), and a spade or *sulki* worth about 2*s.* (Re. 1). Two carts are used for field purposes. The crop cart for bringing home field produce or carrying produce to market is about twelve feet long and three to four feet broad. The floor is made of two strong bars joined by four or more cross pieces at equal intervals. The wheels are of solid timber each of two or three pieces joined together and surrounded by a heavy iron tire two inches thick and nearly two inches broad. The wheels gradually thicken from the rim to the nave. The axle tree, which is an iron cylinder, being considerably below the height of the bullocks, the floor is raised by a tongue resting on the axle. By this means, if the load is well balanced on the cart, the bullocks have comparatively little of the weight, and the draught, being on a level with their shoulders, is easier. From the axle run two poles to the ends of which the yoke is tied. With outriggers on both sides, the cart can carry a very great weight. It is rudely shaped and heavy; even when empty it is a hard pull for one pair of bullocks; when loaded it requires four to six yoke of oxen. It costs £4 to £16 (Rs. 40-160). The manure cart differs from the crop-cart in having high sides made of *tur* stalks or bamboo matting. By removing the sides the manure cart is sometimes used for other purposes. They are drawn by two to three pairs of bullocks.

TILLAGE.

Except a few black soil fields owned by traders and money-lenders which are covered with grass and bushes, because they are let to men who have neither the means nor the heart to work them, tillage is carried on with care and labour. Except when they are thickly covered with *hariáli* (M.), *nat* (K.), or *karige* (K.) grass, Cynodon dactylon, or, when the intended crop is cotton, black soils do not require a yearly ploughing. Ploughing instead of improving harms Indian millet, for if the fall of rain is heavy the black soil runs together and becomes too wet for the proper growth of the young plants. This does not happen when the surface is simply loosened by the large hoe or *kunti*. Red soils require more tillage. The field should be ploughed twice, once lengthwise and once crosswise. When moist, red soils become light, friable, and easily worked. Two bullocks only are required to draw the plough, and the labour and expense are not much more than in hoeing black soil. Besides ploughing it is always necessary to use the large hoe once or twice to all kinds of soils before sowing, and, in the early stages of their growth, both Indian millet and cotton must be frequently hoed and cleaned. Cotton requires particular care. If grass and weeds are not constantly rooted out the young plants are stunted and the outturn is small.

SEASONS.

Dhárwár shares both in the south-west and in the north-east or Madras rains in a greater degree than any other district in the

Presidency. The south-west rains are most felt in the hilly and woody west, the north-east rains in the open east and north, and both about equally in the two southern sub-divisions of Kod and Ránebennur. The prevailing tillage in the west is wet chiefly of early or *mungári* crops; in the east the tillage is dry chiefly of late or *hingári* crops. In Kod and part of Ránebennur, which share in both rains and have both dry and wet tillage, entire failure of crops from drought is unknown, though it often happens that the rainfall favours one kind of tillage more than another. No rainfall can well be too heavy for rice when once it is well above ground; while too much rain harms dry-crop tillage. On the other hand the rainfall which is most suitable for dry-crop tillage is not all that can be desired for rice. The husbandman's year of 365 days is divided into twenty-seven lunar asterisms or star-chambers. These are *Ashvini* of fourteen days from the 11th to the 24th of April; *Bharni* of fourteen days from the 25th of April to the 8th of May; *Kritika* of fifteen days from the 9th of May to the 22nd of May; *Rohini* of thirteen days from the 23rd of May to the fourth of June; *Mrigshirshe* of fifteen days from the 5th to the 19th of June; *A'rdi* of fourteen days from the 20th of June to the 3rd of July; *Punarvasu* of fourteen days from the 4th to the 17th of July; *Pushya* of fourteen days from the 18th to the 31st of July; *A'shlesha* of fourteen days from the 1st to the 14th of August; *Maghe* of thirteen days from the 15th to the 27th of August; *Hubbe* of fourteen days from the 28th of August to the 10th of September; *Uttara* of fourteen days from the 11th to the 24th of September; *Hastu* of thirteen days from the 25th of September to the 7th of October; *Chette* of fourteen days from the 8th to the 21st of October; *Svâti* of thirteen days from the 22nd of October to the 3rd of November; *Vishákhe* of thirteen days from the 4th to the 16th of November; *A'nurádhi* of thirteen days from the 17th to the 29th of November; *Jeshtha* of thirteen days from the 30th of November to the 12th of December; *Mul* of fourteen days from the 13th to the 26th of December; *Purvásháda* of thirteen days from the 27th of December to the 8th of January; *Uttrásháda* of thirteen days from the 9th to the 21st of January; *Shrávana* of thirteen days from the 22nd of January to the 3rd of February; *Dhanishte* of thirteen days from the 4th to the 16th of February; *Shutatare* of thirteen days from the 17th of February to the first of March; *Purvábhádre* of fourteen days from the 2nd to the 15th of March; *Uttrábhádre* of twelve days from the 16th to the 27th of March; and *Revati* of thirteen days from the 28th of March to the 10th of April. Seven of these between *Kratika* and *A'shlesha*, that is between the 9th of May and the 14th of August, form the early or *mungári* season; six between *Maghe* and *Svâti*, that is between the 15th of August and the 3rd of November, form the late or *hingári* season; eleven between *Hastu* and *Shrávana*, that is between the 25th of September and the 3rd of February, form the harvesting season; and seven between *Uttarásháda* and *Revati* that is between the 9th of January and the 10th of April form the cotton-picking season.

The normal Dhárwár rainfall may be divided into three periods. The first lasts from the middle of April to the end of the first week

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in June. Every ten or fifteen days in these six weeks should have a heavy easterly thunderstorm with half an inch to two inches of rain. These falls are wanted for the western rice lands that the rice may be sown before the end of May. East of Hubli these showers have no special use as the black soil grows no rice, and no crops are sown before the end of June or the beginning of July. The next period is the south-west monsoon, which lasts from the middle of June till the middle or end of September. The monsoon should begin with about a week of heavy showers lasting some hours every day to soak all land intended for early *jvári* or *rági*. After a week's rain should come a nearly fair week that field work may be pressed on. The first sowings of *jvári* should take place in early July. The whole of July should be wet, with few entirely dry days. August is generally a dry month, with as a rule not more than two to three inches of rain. These August showers moisten the surface of the eastern plain and prepare it for the sowing of late or white *jvári* and cotton. The date of sowing white millet and cotton varies with the rainfall from the middle of August to the middle or even the end of September. Wheat mixed with linseed or safflower is sown still later. September should be moderately wet with many fine days. The harvest depends on October more than on any other month. October is also the month of most uncertain rainfall. If no rain falls in October, as was the case in 1876, the cotton, the late *jvári*, and the wheat are entirely lost. If unusually heavy rain falls in October, as fell in October 1877, the early *jvári* ears sprout. The whole of the October rainfall is from the east. It is not steady rain, but comes in sudden and heavy downpours which last an hour or two. The whole October rainfall should be about six inches, half an inch to two inches falling in one heavy plump every few days. This gives all the moisture which the cotton, wheat, and later *jvári* require. After October the less rain that falls the better both for harvesting the early *jvári* crop and for the health of the growing cotton wheat and other late crops. December and January seldom pass without a few days often of heavy rain. In the east heavy December and January rain mildews the wheat; in the west heavy December and January rain does little harm as the rice and early *jvári* are harvested in November and early December.[1]

CROPS.

In 1881-82 of 1,507,942 acres the whole area held for tillage, 184,776 acres or 12·25 per cent were fallow or under grass. Of the remaining 1,323,166 acres, 1661 were twice cropped. Of the 1,324,827 acres under tillage, grain crops occupied 756,034 acres or 57·06 per cent of which 389,411 were under Indian millet *jola* (K.) or *jvári* (M.) Sorghum vulgare, 174,827 under wheat *godhi* (K.) or *ghau* (M.) Triticum æstivum, 85,117 under rice *bhatta* (K.) or *bhát* (M.) Oryza sativa, 47,830 under *navani* (K.) or *káng* (M.) Panicum italicum, 28,859 under *rági* (K.) or *náchni* (M.) Eleusine corocana, 17,911 under *sáve* (K.) or *vari* (M.) Panicum miliare, 4099 under spiked millet *sejje* (K.) or *bájri* (M.) Penicillaria spicata, one under

[1] Mr. F. L. Charles, C.S., in the Famine Commission Report, 14-15.

maize *mekke jola* (K.) or *makai* (M.) Zea mays, and 7977 under other grains of which details are not given. Pulses occupied 101,197 acres or 7·63 per cent, of which 33,035 were under gram *kadli* (K.) or *harbhara* (M.) Cicer arietinum, 25,575 under *togari* or *tuvari* (K.) or *tur* (M.) Cajanus indicus, 24,200 under *hurli* (K.) or *kulthi* (M.) Dolichos biflorus, 14,760 under *hesaru* (K.) or *mug* (M.) Phaseolus radiatus, 426 under *uddu* (K.) or *udid* (M.) Phaseolus mungo, and 3201 under other pulses. Oilseeds occupied 70,426 acres or 5·31 per cent, of which 14,734 were under linseed *agashi* (K.) or *javas* (M.) Linum usitatissimum, 3694 under sesamum *yellu* (K.) or *til* (M.) Sesamum indicum, 41 under Indian mustard *sásive* (K.) or *rái* (M.) Sinapis dichotoma, and 48,957 under other oilseeds. Fibres occupied 359,210 acres or 27·11 per cent, of which 357,701 were under cotton *hatti* or *arale* (K.) or *kápus* (M.) Gossypium herbaceum, 1222 under Bombay hemp *sanbu* (K.) or *tág* (M.) Crotalaria juncea, and 287 under Indian hemp *pundi* (K.) or *ambádi* (M.) Hibiscus cannabinus. Miscellaneous crops occupied 37,960 acres or 2·86 per cent, of which 28,748 were under chillies *menasinakai* (K.) or *mirchi* (M.) Capsicum frutescens, 3742 under sugarcane *kabbu* (K.) or *us* (M.) Saccharum officinarum, 1251 under tobacco *hage soppu* (K.) or *tambáku* (M.) Nicotiana tabacum, seven under ginger *shunti* (K.) *alla* (M.) Zinziber officinale, and the remaining 4212 under various vegetables and fruits.

Indian Millet.

The following are the details of some of the most important crops: Indian Millet, *jola* (K.) *jvári* (M.) Sorghum vulgare, with in 1881-82, 389,411 acres or 29·39 per cent of the tillage area, is the most widely grown crop in the district, the grain forming the husbandman's chief food and the straw supplying the best cattle fodder. In good black soil free from weeds for Indian millet the land is treated in the same way as for cotton. Red soils must be manured and ploughed before the leveller or *korudu* is used. No fewer than eighteen varieties of Indian millet are grown in Dhárwár. Of these two *bili jola* (K.) and *kari-goni jola* (K.), the finest of the whole are late or *hingári* crops. The remaining sixteen are *mungári* or early varieties. Of the sixteen early varieties six, *murtinjola, dhodajola, utal-phulgara, chejkara, kagi-jola* and *nandihál* are sown as regular crops, never as occasional rows among other crops; a seventh variety *bhagvant phulgara* is sown both as a single crop and in rows among another crop. All of these seven mature in three to four months. The seven other varieties *patansáli, gavri kulu or kulmudumugu, lasvanpadu, phulgara, jelkonjola* or *jogi-jedi-jola, ken-jola,* and *kodmukanjola* are, except *kodmukanjola,* sometimes sown as regular crops but usually as occasional rows in fields of *navani* Panicum italicum or *rági* Eleusine corocana. *Jelkanjola* does so well as an occasional row crop that it has the special name of *ukkudi jola, ukkudi* meaning an occasional row. When sown with late crops all of these seven are intended only to supply cattle with green fodder. The two remaining varieties *halmukan-jola* and *ulkanjola* are mixed with some of the above varieties before they are sown. These two may be eaten roasted; they are never made into bread. The early or *mungári* kinds are sown in July and August, and are reaped from October to

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December. Along with the early Indian millet generally in every fourth row or drill, are sown cajan pea *hurli* or Dolichos biflorus and *mataki* or Phaseolus aconitifolius which thrive with the same preparation of soil as the millets. The late or *hingári* Indian millets are sown in October, and reaped in February and March. With them are sown occasional rows of safflower gram and linseeed. Unless the ground is well manured Indian millet is not sown in the same field for two successive years; the second crop is either cotton, wheat, gram, or safflower.

Rági.

RA'GI (K.) or *náchni* (M.) Eleusine corocana, with 28,859 acres or 2·17 cent of the tillage area, is grown both in red and black soils, but generally in the red soils of the hilly west. Of two kinds of *rági* both are sown in June after the first burst of the south-west monsoon, and reaped one kind in October and the other in December. In preparing red soil for *rági* the ground is ploughed with the large plough and is afterwards broken and levelled. Manure, at the rate of one or two cart-loads an acre, is laid in heaps at equal distances, and the seed is thoroughly mixed in the manure. Furrows are cut with the small plough, the sower following the plough with a basket full of mixed manure and seed which he drops in the furrow, his basket being kept full by a man who walks to and from the heap. When the sowing is over the leveller or *korudu* breaks the clods and covers the seed, the light hoe or *ballesal kunti* is passed over the surface, and is once more followed by the leveller. Along with *rági* a little mustard and the variety of Indian millet known as *ukkadi-jola* are sometimes sown. At intervals a row of cajan pea is drilled in. Thirty five years ago (1848) when wood-ash or *kumri* tillage prevailed, *rági* and *sáve* were planted in forest clearings. In these clearings no manure but the ashes of cut underwood were used. The same clearing only yielded a crop two years in succession when the ground was left fallow till the underwood had grown high enough to be again burnt.

Sáve.

SA'VE (K.) or *vari* (M.) Panicum miliare with 17,911 acres or 1·35 per cent of the tillage area, is grown in the same way as *rági*. Of two varieties, one, *muligi sáve* is sown in June after the first burst of the south-west monsoon, and reaped in September; the other is sown from the 1st to the 15th of September and reaped in late December. *Muligi sáve* or early panic is seldom grown in the western forest villages, because, as it ripens before any other grain it has to bear the whole attacks of the wild hogs which infest those parts, and it is not valuable enough to make it worth watching.

Wheat.

WHEAT *godhi* (K.) or *ghau* (M.) Triticum æstivum, with in 1881-82 174,829 acres or 15·19 per cent of the tillage area, is grown chiefly in Navalgund, Gadag, Hubli, Ron, and Dhárwár. It does not thrive well in Bankápur. The three chief varieties of wheat are the red or *támbda*, the local or *jvári* apparently meaning Karnátak, and the *deshi* also local apparently meaning Deccan. Of these the red is the finest and is much like English wheat. Wheat is the last sown of the cold weather crops. It is not sown till the October rains are over, and there is no chance of more rain. Wheat is generally grown in good soft black soil which has been thoroughly broken by the large plough followed by

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Wheat.

the heavy hoe or *kunti* and the light hoe or *ballesal kunti*. Twenty-four to forty pounds of seed an acre are sown through the seed drill and the soil is again worked with the light hoe. After this it wants no weeding or other care. Wheat is grown every third year, and is followed by Indian millet. In some places wheat alternates with sugarcane and gram and occasionally safflower is raised between the rows of wheat two to six feet apart. Safflower does not ripen till a month after the wheat and does not interfere with its growth. The wheat crop takes three to three and a half months to ripen. Towards the end of December it should have one good shower. When the seedlings are about a month old they are apt to suffer from rain or dew, and from a disease called *bhandar* which is caused by westerly winds. Southerly winds are also unwholesome. Excessively cold breezes bring on a disease called *ittangi* (K.) which makes the wheat plants turn reddish and bear poor or no ears. The acre outturn is said to vary from 60 to 300 pounds and to average about 200 pounds. The average wholesale rupee price of wheat is about thirty pounds. Wheat is not the staple food of the people of the district. It is used only by the rich and the well-to-do. In the south of the district a little wheat is brought from Kumta in North Kánara. Of the local wheat some is sent to Belgaum. At present (1884) the cost of carriage to Belári, the nearest railway station, is about £2 8*s*. (Rs. 24) the ton.

Rice.

RICE *bhatta* (K.) or *bhát* (M.) Oryza sativa, with 85,117 acres or 6·42 per cent of the tillage area, is grown almost wholly in the woody west which is locally called *malládu* or hill land. Rice wants much and constant moisture. When it depends on rainfall alone rice is always uncertain, but this element of chance rather fascinates the people. Most rice land is independent of simple rainfall for its water-supply. The lowlying lands are watered from ponds and much is also watered by drainage from neighbouring high grounds guided by water-courses or *kalvás*. Failing pond water irrigation is supplied from wells or more commonly from holes fed by underground soakage from ponds. The rice soil is red towards the extreme west, and further east it is a light coloured clayey mould. This clayey soil, by the action of water, tillage, and weather, becomes stiff, compact, and very retentive of moisture. This kind of rice soil is poor, middling, or good according to its situation. In high and exposed sites it is poor and shallow, even with care and manure able to bear only one crop of poor rice; in middle situations neither very high nor very low it is middling, of some depth, and where there is moisture enough, yields two crops, one of rice and the other of pulse; in low lands or valleys it is of superior richness, of a rich dark brown, and yields excellent after-crops. Regular rice fields are divided into level compartments a few feet to fifteen or twenty yards broad and varying in length according to the landholder's pleasure or the position of the ground. The slope of the ground or hill side is generally carried into a series of terraces each one or two feet higher than the one immediately below it, and the front of each is guarded or raised by a foot high embankment forming part of the descending step. The effect of a hill or rising ground terraced in rice plots is extremely pleasing. The three kinds of rice-land require almost the same labour. After harvest the poor soil seldom holds

Chapter IV. Agriculture. Crops. *Rice.*

moisture enough to allow of its being ploughed; middle class soil even when not moist enough to yield an after-crop, is always damp enough to be ploughed, and the ploughing is a gain as it makes the land more ready to receive the occasional dry-season showers. The upturned grass and stubble roots die and rot, and the stiff clods crumble in the heat and air. At the end of March manure is laid in heaps. In early April the clods are broken by the leveller or *korudu*, or, if still very hard, by labourers with clubs. In fields which have not been ploughed after harvest nothing, except the laying of manure, can be done till the first rains of late April or May, when the field is ploughed and the clods are broken by the mallet. The manure is then scattered broadcast from a basket, the surface is turned by the heavy hoe or *kunti* and the leveller or *korudu* follows. Nothing further is done till rain enough falls to admit of sowing for which a small seed-drill or *kurgi* is generally used. An acre of rice land on an average wants three to five loads of manure. If more is laid on, and the rains are abundant the crop will gain greatly; but with light rain in highly manured land the crop will grow too freely and will probably dry without coming to ear. From the 25th of May to the end of June, as soon as the village astrologer has fixed the lucky day, the seed drill is decked with green leaves, the husbandman bows before it, and sowing begins. The drill is closely followed by the *balle-sal-kunti* or light hoe to cover the seed, and the *korudu* follows to level the surface. In about eight days the seed sprouts, and in eight days more weeding begins with the *yadi kunti* or grubber and is repeated generally once in ten or twelve days. In two months the seed drill is used for weeding, as the crop is too high and the fields are too full of water for the grubber. The weeds are always left to rot where they grew, and this constant supply of vegetable matter is one chief cause of the peculiar richness of the soil. The surrounding ridges are repaired, the earth cut from the front is heaped on the ridges, the beds are filled with water, and the leveller is passed over the crop. This gives the soil a smooth and beaten surface into which the water does not readily sink, but remains in pools.

The rice harvest begins about the 15th of November in the drier land, but many hollows where water lies deep are seldom ready for reaping before the end of December. An unusually dry or wet season may hasten or delay the harvest a fortnight either way. When rice is reaped it is left to dry on the field. It is then tied in sheaves, built ears outwards in a stock, and left to season for a month. A pole is fixed in the field, and the ground for a few yards round the pole is beaten hard and cowdunged to prevent cracks. The floor is cleaned and swept, and the loosened sheaves are scattered over it, and six or eight muzzled bullocks packed side by side in a line are slowly driven over the sheaves round the pole. This goes on till all the grain has been trodden from the straw. The straw is then removed, and fresh sheaves are laid and trodden. Winnowing follows thrashing. Rice is winnowed by filling with grain a flat basket which is raised at arm's length and slowly emptied into the air with a slight and regular shake. The winnowing wind blows aside the dust and the leaves, and the clean heavy grain falls on the ground. When a heap

has been collected the grain is carried to the village, the outer husk is removed by a wooden hand-mill or *tolulikalu* (K.) and as before is a second time winnowed. When the operations are over, the rice is stored in a large round basket or wattle-and-daub safe, raised a little from the ground on beams laid across large stones, and roofed with thatch. Every husbandman's house has one grain basket in which rice and almost all other grains are stored. The only grains which are generally stored in pits are Indian millet, wheat, gram, and cajan pea. Nine chief kinds of rice are grown in Dhárwár. Of these two, *ámbemori* and *konksáli sanbhatta* are of good quality, three *bedarsáli, somsáli,* and *hakkalsáli* are of medium quality, and four *dodigan* a large grained variety, *hempgan* or red, *kerekgan* or black, and *gensáli* are of poor quality. All are sown at the same time, and are reaped one after the other at short intervals. In a fair proportion of rice fields sugarcane is grown once every third year. Where the soil has good natural moisture sugarcane is grown without watering, and, where the water supply is plentiful, with as much watering as may be necessary. The only cane which is grown without any irrigation, except a single flooding of the land when it is planted, is the small grass cane which is locally known as *hol-kabbu.* The cane which does not succeed without occasional watering during the dry season is the large or garden cane locally known as *gabras dali.* Green crops of *mug, pávta, matki,* and gram are also grown after rice in hollows which hold their damp till late in the year. Except in red and light coloured soils, a second crop of cane is seldom grown without watering.

Tobacco.

Tobacco[1] *hage soppu* (K.) or *tambáku* (M.) Nicotiana tabacum, with 1251 acres or 0·09 per cent of the tillage area is found chiefly in Ránebennur, Dhárwár, and Ron. Tobacco is seldom grown near the western forests, as the red gravelly soil does not suit it. It is chiefly raised in the east light-black soil. Rich alluvial soil is preferred, though, when watered, a mixture of red and black soil is found very suitable. The site of the tobacco field should be near the village as there it is more easily manured and guarded. Much less tobacco is grown than might be grown. Lingáyats, at least Lingáyats who have children, dislike growing tobacco, for they have to cut the young shoots and this sin is apt to bring sickness on the family. In June the seed is sown carefully in prepared beds. If the season is early, the seedlings are ready for planting in August; if the season is late they are ready in September. The field must be richly dressed with mixed pit manure. The leaves are ready for cutting in December or January. As a rule the whole plants are cut, stem as well as leaves. In most cases a poor second growth comes from the root and this second crop is allowed to flower and its seed is saved. The average acre yield varies from about three hundred pounds in Dhárwár, to two hundred pounds in Ron. At four pounds the rupee this leaves

[1] From Mr. E. P. Robertson's letter 3261 of 20th September 1873 to the Revenue Commissioner S. D.

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Crops.

Tobacco.

the husbandman a net acre profit of £4 to £6 (Rs. 40-60). The quality of the tobacco is not good; much of the home market is supplied from tobacco brought for sale from the banks of the Krishna. Tobacco is cured in three slightly varying ways. The stems, when cut are split, and for four to seven days are left in the field to dry. If there is dew they are left alone, if there is no dew they are sprinkled with water, or, in some cases, with a decoction of *kavási hallu* grass, catechu, and coarse sugar or *jágri*. The stems are buried four or five days, taken up during the cool of the day, dried, sorted, and tied for final disposal. The same plan is adopted if the leaves are plucked from the stem. In some places after the plants are cut they are left in the field for eight days, tied in bundles of twenty to twenty-eight, and carried home. They are piled in heaps with the leaves inward, and covered with matting to keep off wind and rain. After about a fortnight the mats are taken away, the tobacco is aired for a day, and heaped as before. This process is repeated four times when the tobacco is considered cured, and is sorted and tied into bundles. According to the third process after the leaves have been cut they are exposed to dew for ten or fifteen days, and if there is no dew the leaves are watered. The leaves are then fairly dried and buried with two layers of leaves and one layer of earth. After three days they are taken in the cool of the day and spread outside of the house. Two days later they are tied into bundles which are turned every eight days. At the end of a month the tobacco is cured. If tobacco is cut before it is ripe or if it has been over-fermented in curing it is apt to be attacked by insects. In 1872 Mr. E. P. Robertson, then Collector of Dhárwár, tried to introduce both Havana and Shiráz tobacco. The seed of these two exotics was sown in eighty-seven villages of which twenty-two belonged to Ron, thirteen to Gadag, twelve to Ránebennur, eleven to Karajgi and Sávanur, eight to Hubli, six to Kod, and four to Dhárwár. In some of the villages in which the seed was planted the crops withered from want of rain, but in many the crops came to maturity. In every case the husbandmen were pleased with the tobacco. Compared with the local tobacco it had much larger leaves, the crop was twenty-five per cent heavier, it was of a stronger and better flavour, and it fetched a higher price. Mr. Robertson doubted (1873) if the foreign tobacco could ever be well enough cured for the English market.

Sugarcane.

Sugarcane *kabbu* (K). or *us* (M.) Saccharum officinarum, with 3742 acres or 0·28 per cent of the tillage area, is chiefly grown in the damp west or *malládu* and occasionally in gardens in the dry east. Except that when it is grown in a field it is planted in a field from which rice has been reaped, the garden and field tillage of sugarcane are much the same. The chief point is that the land must be damp enough. In December before the cane is planted the ground is prepared by breaking and levelling the rice-field ridges. After a week the small plough or *ranti*, with two or more pairs of bullocks, is drawn three or four times across the ground. The clods are broken by the *korudu* or leveller, and in January the heavy hoe or *kunti* and the light hoe or *ballesal kunti* are used to powder and level the surface. Manure is laid in heaps,

as Mr. Shearer's experience went, the only effect of watering either American or local cotton was to develop the plant at the expense of the fibre. The late Colonel Meadows Taylor, C.S.I., made experiments in watering Dhárwár-American cotton, and the result was a failure. The leaves were curled, the bolls soft, and the fibre weak. He agreed with Mr. Inverarity, then Collector of Broach, that watering cotton in deep black soil would prove injurious both to the quality and to the quantity of the fibre. The black or *regur* soil, in which cotton is almost always grown, is very deep and moisture-holding. Though the surface seems dry, and no doubt is dry as far as the plough or hoe has disturbed it, yet, after an ordinary rainfall, the under-soil always keeps moist, not only beyond the time at which cotton ripens, but even during the whole of the hot weather. The roots of the cotton plant strike very deep. The tap root passes at least two feet below the surface, generally three to four feet, sometimes as much as eight feet. Even the side shoots pass down when they find the surface soil begin to dry. A certain dryness in the soil is apparently needed to bring the fibre to perfection and to cause the bolls to open. Colonel Taylor thought that in deep black soil the ordinary rainfall was enough for the plant. Its whole growth, and for the most part its buds and flowers and green bolls were produced while the subsoil was wet. As the soil dried the stem of the cotton plant stiffened, the bolls hardened and ripened, and the cotton burst forth. If the ground was kept damp, there would be a danger that the plant would throw out fresh shoots and fail to ripen the bolls.

Change.

Cotton takes much out of the soil. Unless he is tempted by high prices, the Dhárwár landholder does not grow cotton oftener than once in three years. Still as it commands a sure and profitable market, cotton is often sown every second year, and in some of the richest soils it is grown season after season. Where it is planted season after season the crop is poor and the soil is much weakened. The area under local or Kumta cotton varies year after year with the labour market, that is with the quantity of labour forthcoming for cleaning. Thus, if labour is scarce and dear and the farmers find they have a large balance of unginned native cotton in stock, they will not sow that year as much as they would have sown if their stock had been sold and labour was cheap and plentiful. The area under cotton is also affected by the balance of grain and bread stuffs in hand, and also by the rainfall. If the rain is heavy in the early part of the season, there is a large sowing of millet and other wet crops; if the rain holds off until August or September, there is a large area under cotton, but, if the August rain also holds off and there is but little rain till October, wheat and gram take the place of cotton.

Manure.

Cotton fields are manured some time before the cotton is sown. The husbandmen say that if manure is put in along with or immediately before the cotton seed and the rainfall is scanty, the manure does not mix with the soil, and injures the cotton plant especially the American plant. The manure used is pulverised village refuse and rubbish, and occasionally oil plant or some other quick growing crop is raised and ploughed in. The soil is generally manured every second or third year.

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COTTON. *Tillage.*

Many of the better class of husbandmen take great care in preparing their cotton land. It is cleared of all the stumps of the previous crop by the heavy hoe or *kunti*. Wherever it is overgrown with the *karige* (K.) or *hariáli* (M.) Cynodon dactylon grass, the land is ploughed with the heavy plough. Even repeated workings of the heavy plough do not always succeed in uprooting the entangled and deep rooted *hariáli*. Field labourers are engaged who turn out with pickaxes or *kudlis* (K.) and dig the land often two feet deep. This is very slow and hard work, but the result repays the severe labour and the expense. After ploughing, or deep digging, the heavy hoe or *kunti* is again used to thoroughly loosen the soil. When the soil is thus broken and smoothed it is considered ready for the seed. The Dhárwár husbandmen take the greatest care not to sow cotton at any time which will bring the plant to maturity at a season when heavy falls of rain may be expected. As a rule cotton sowing begins in the latter part of August. By this time the land has been thoroughly soaked, and is so far drained that the surface is comparatively dry. A fairly dry surface with much moisture below is the state in which land should be for sowing either American or local cotton. Soil in this state helps the seed to sprout and draws the tap roots deep enough to support and bring the plant to perfection, when the hot weather and the trying east winds set in. Before sowing it New Orleans seed is rubbed by the hand on the ground in a mixture of cowdung and water; for their woolliness keeps the seeds from running freely through the seed drill. The seed is sown with the aid of the *kurgi* or seed drill which has iron teeth eighteen inches apart, to each of which a hollow bamboo tube called *yellishedi* (K.) is fastened. Bullocks are yoked to the seed drill, and, as they work, the iron teeth plough two drills, and in these drills the cotton seed is dropped through the bamboo tubes. The seed drill is immediately followed by the hoe which closes the drills. Frequent hot sunny days after sowing promote sprouting and about three months more remain during which from time to time rain may be looked for. The seed leaves begin to show in six to twelve days. In about a month, when the plants are three or four inches high, the farmer takes his grubber or *yadikunti*, and works it between the cotton plants, doing two rows at a time. The grubber roots up all young weeds and grass. At the same time it turns the surface soil, keeps it from souring, and heaps the soil at the roots of the young plants. This heaping of the soil is repeated several times, the oftener the better, until the plants grow too high to work the grubber. The more hardworking and careful husbandmen supplement the grubber with hand labour. For this men, women, and children are employed on 3*d.* to 6*d.* (2-4 *as.*) a day, weeding at surprising speed with a *kurchegi* or miniature sickle. By the beginning of October, a strong, dry, cutting east wind sets in. The east wind lasts till about the middle of November, when the strain is eased by occasional moist southerly and westerly breezes and timely heavy thunderstorms. After this the dry east wind again sets in and blows steadily till January. The American cotton plant usually flowers in December, often ten days to a fortnight in advance of the local plant. Its cotton bolls mature in February and March. A good American

crop usually yields five pickings, with a week between each; a poor crop not more than three pickings with a fortnight between each. All of the picking, and, in the case of the local cotton, almost all of the ginning, is done by women and children, the men's share in the labour ceasing when the plants are full-grown.

Crossing.

Crossing has very often been tried in Dhárwár with a view to improve the different varieties. Attempts have especially been made to cross the local plant either with New Orleans, Sea Island, or Egyptian, so as to keep the hardiness and strength of the local plant, and gain the silkiness, length, and large outturn of these foreign varieties. So far back as 1859 the Bombay Chamber of Commerce explained the decline in the quality of Dhárwár American cotton to natural crossing, the result of mixed sowing of the local and foreign varieties. Such a result Dr. Wight (1842-1850), a botanist and a practical cotton planter in Koimbator, thought impossible. In 1872, Mr. Shearer stated that in his experience the cotton of plants grown from seed that had been looked on as crossed, on coming to maturity, showed no marked improvement on those of the parent plant. The only difference was in appearance. Plants obtained by crossing local and Egyptian grew well, but their bolls did not ripen. A cross of Egyptian or Sea Island with American seemed always to run out and the plants dwindled after the second year. If they ever produced bolls the staple was weak. Mr. Shearer tried to cross the different local varieties. The look of the plant often changed, still he could not say whether they were crosses or sports. Mr. Shearer traced the apparent changes, which often deceive an unprofessional eye, to difference in season, situation, and tillage.

Diseases.

Dhárwár cotton is liable to two diseases, *benithgi rog* (K.) and *karaghi rog* (K.). *Benithgi rog* is brought on by continued hard cutting easterly wind; it turns the leaves red and blights them; the flowers and pods fall off without maturing and the plant slowly dies. *Karaghi rog* is brought on by cutting easterly winds with heavy morning dews and fogs; it disappears if a westerly wind sets in before the disease has gained too strong a hold.

Outturn.

According to the season the acre yield of clean cotton ranges from fifty to 120 pounds, the yield of American cotton being greater than that of country cotton. According to the 1882-83 cotton report, during the five years ending 1882-83, the acre yield was estimated at fifty pounds of American cotton and forty-two pounds of local cotton. The cost of growing cotton is difficult to determine. Much depends on the grower the number of cattle he owns, the area of land he holds, the number of persons in his house, and many other conditions which more or less affect his actual cash outlay in growing cotton. Roughly the acre cost of growing American and local cotton is 11*s.* 4½*d.* (Rs. $5\frac{11}{16}$). As the value of the American crop may be set down at £1 10*s.* (Rs. 15) and the value of the local crop at £1 4*s.* 9*d.* (Rs. $12\frac{3}{8}$) the American leaves a net profit of 18*s.* 7½*d.* (Rs. $9\frac{5}{16}$) and the local of 13*s.* 4½*d.* (Rs. $6\frac{11}{16}$). To the net profit on the country cotton a small amount may be added, as in many cases the husbandman's family themselves clean the cotton.

Improvements.

In 1819, a year after Dhárwár passed to the British, the commercial resident in the ceded districts, recommended that

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COTTON. *Improvements.*

50,000 to 100,000 pounds of Brazilian cotton seed and some quantity of New Orleans and Sea Island cotton seeds should be procured and distributed in Dhárwár. To tempt the husbandmen to try these foreign cottons it was proposed to offer a reward of £17 10*s.* (50 *pagodas*) in cash or in the shape of a gold medal and chain on the first delivery of five hundred pounds of clean white cotton free from seed dirt and leaf, that is at the rate of about 17*s.* 6*d.* (2½ *pagodas*) for each *man* of twenty-five pounds. This proposal was approved by the Madras Government, but it does not seem to have been carried out. In 1824 it was noticed that much land fit for growing cotton lay waste. The cost of clearing rich land was so great that a lease or *kaul* of nine or ten years of light rent was not inducement enough to tempt the people to undergo the expense. In 1829 under orders from the Court of Directors, to improve local cotton and introduce fine foreign varieties, experiments were begun in Dhárwár under Dr. Lush, who, in addition to his ordinary duties as superintendent of the botanical gardens at Dápuri in Poona, was entrusted with cotton experiments in Khándesh and Dhárwár. Dr. Lush reached Dhárwár too late in the year to sow cotton. He bought some fields of growing plants, and proposed to clean cotton in a way which could increase its value without adding much to its cost. He also proposed to distribute the seeds of the best Gujarát, New Orleans, and other annual cottons, which would ripen in the course of the season, so as to produce new varieties of the staple. The cotton bought and cleaned by Dr. Lush was favourably noticed in England and was valued at 5½*d.* to 5¾*d.* (3⅔ - 3⅝ *as.*) the pound, when Indian cottons were selling at Liverpool at 3*d.* to 6*d.* (2-4 *as.*) the pound. In the next season Dr. Lush chose land for a small cotton farm at Sigihalli in the Khánápur sub-division of Belgaum. The land was so situated that, if necessary, it could be watered by a stream. Partly owing to a bad season, but chiefly owing to the damaged state in which the foreign seed was received, the experiment failed; the entire crop sent to England amounted only to four bales. Of these four bales two, of a kind not recorded, were valued at 7½*d.* to 8½*d.* (5-5⅔ *as.*) the pound, one of American upland seed at 8*d.* to 8½*d.* (5⅓-5⅔ *as.*) the pound, and one of Dhárwár New Orleans at 8*d.* (5⅓ *as.*) the pound. At this time the average price of Indian cotton in England was 4¼*d.* (2⅚ *as.*) the pound. In spite of these high prices all four packages turned out unfit for spinning. Small quantities would still command the high prices named for candle-wicks and jewellers' purposes. The cotton was cleaned by a foot roller so ineffectively that the work had to be supplemented by a number of hand-pickers behind the foot rollers, who had to pass the whole of the ginned cotton through their hands and remove from it the broken seeds and dirt that had passed the roller. £6 (Rs. 60) were spent in cleaning 784 pounds of cotton. The landholders were unwilling to go on trying foreign seed. The yield was less and the quality was poorer than that of the local cotton. About this time (1829) a quantity of Broach cotton cleaned by the foot roller sold for 5¾*d.* to 6*d.* (3⅝-4 *as.*) the pound.

Between 1829 and 1832 the results of the sowings of American cotton seed at Navalgund, Dhárwár, and Morab were various. The seed was liable to fall off in quality, they withered, and got to look like the seeds of poor black-seeded cotton. In proportion to the seed distributed Dr. Lush received very little cotton. Some American seed sown as perennial and tried at the Sigihalli farm failed. Some Broach and Jambusar seed was tried at Navalgund, but the pods were attacked by field bugs, and the produce was poorer than that of the local cotton. About 1830 a small trade in Dhárwár cotton sprang up with China, and the Canton merchants highly approved of the consignments that were sent to them. In 1831 at the Sigihalli farm, five pounds of Pernambuco seed at first promised well, but the plants were afterwards blighted. In November 1832 the plants were recovering, but up to that time there had been no outturn. Some Bourbon seed was tried with Pernambuco, but it did not come up. Some seed of a white-seeded perennial from the Dápuri garden was thought likely to turn out a fine silky cotton, and was prepared by the saw-gin. In 1832 some Egyptian was tried, and in November, Dr. Lush, notwithstanding a dry season, thought it more promising than the other varieties. During 1833 the results continued most discouraging. The Pernambuco was a complete failure in black soils and the American green-seeded varieties, that is Georgian Uplands and New Orleans, were found to degenerate rapidly and to yield thin unsatisfactory crops. In 1834 Dr. Lush thought Pernambuco might succeed in fairly moist red soil. Pure black soil was death to this seed. In 1835 experiments at the Sigihalli farm convinced him that Pernambuco would never answer in Dhárwár. He thought Egyptian might succeed as an annual, as it bore a good crop the first year, and the proportion of its wool to seed was double that of the local cotton. In 1836 the Collector, Mr. Baber, while giving his opinion on the Sigihalli farm, said that though the experiments had gone on for five years, not a single landholder close to the farm had in the slightest degree changed his mode of cotton tillage, of gathering the crop, or of preparing it for market. About this time Dr. Lush showed that a new ginning machine was required, as the foot roller was not suited to foreign cotton, and as the American gin was a failure. In 1836 the Dhárwár experiments were closed. They were considered to have failed after a fair trial. Still Mr. Mercer the American planter, when looking over a collection of experimental cottons at the India Office in London in 1840, picked out samples of Dr. Lush's white-seeded perennial which he said were quite equal to good New Orleans.

In 1838 several commercial bodies in Great Britain urged measures for improving Indian cotton. In consequence of this agitation, Captain Bayles of the Madras Army was sent to America to engage the services of trained men to teach the people of India how to grow and prepare cotton. Ten American planters were engaged and started for India in 1840 with a large quantity of the best cotton seed, some American tools, cotton gins, and presses. Of the ten planters three came to Bombay. In 1841 the Collector, Mr. A. N. Shaw, to whose steady and persevering

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efforts much of the success of the attempt to acclimatize American cotton in Dhárwár is due, planted, on the local system, some ten acres in Hubli with some of the Mexican seed sent by the Court of Directors. Mr. Shaw believed that of all Western Indian climates the Dhárwár climate was most like the climate of the United States cotton-growing districts. Mr. Shaw was right, and his cotton, though the seed was old and though the plants were grown under many disadvantages, was declared by the local landholders and merchants better than their own, and was valued by the Bombay Chamber of Commerce at £1 to £1 10*s.* (Rs. 10-15) the *khandi*, that is twelve to eighteen per cent, higher than the best Broach, then the standard staple at Bombay. Mr. Shaw's fields gave ninety pounds of clean cotton the acre, while the neighbouring fields sown with local cotton returned only forty-five pounds the acre. Mr. Mercer one of the American planters, who reached Dhárwár about this time, was so satisfied with Mr. Shaw's fields, that his doubts of American cotton becoming a valuable Indian product disappeared. In spite of his success Mr. Shaw thought that no rapid spread of American cotton was possible, unless a simple portable gin was introduced. At this time most of the landholders were deep in debt and worked without spirit. The ordinary way of gathering the cotton crop was to let it fall on the ground and lie on the ground till the cotton bushes ceased bearing. Then the people went out and gathered it all in one gathering. They mixed the fresh and the old, making no attempt to separate the clean from the dirty. About the same time (1841-42) Mr. Hadow, then assistant collector, grew some Bourbon seed cotton on the native plan in the black soil of Gadag. The return was thirty-one pounds of clean cotton the acre. Bourbon is a perennial and seldom yields more than thirty pounds during the first season. The sample cleaned by the foot roller was especially praised by the Chamber of Commerce for its beautiful cleanness. In 1843 Mr. Mercer, with his assistants Messrs. Hawley and Channing, began an experimental cotton farm at Kusvugal five miles north-east of Hubli. The system was that followed by the Dhárwár husbandmen. The only change was that seed was sown at intervals from early June, while the local husbandmen never sow till late in August. In this year 545 acres were under foreign cotton. Of these 183 were planted by Mr. Mercer with six different varieties, eighty acres with New Orleans, sixty-three with Broach, sixteen with Koimbator from acclimatized New Orleans seed, eleven with Abyssinian, ten with Bourbon, and three with Sea Island. The result at first was discouraging, mainly owing to the effects of the constant high winds of the early months of the south-west rains. By September appearances greatly improved and Mr. Mercer described the prospect as truly promising. This was the case not only with the experimental farm but also with the fields of the local farmers. In spite of damage caused by heavy rain early in October, which also told on other cotton fields, Mr. Mercer considered his outturn better than any he had seen in India. The acre yield of clean cotton was fifty-four and a half pounds of New Orleans, thirty-two pounds of Broach, fifty-four

pounds of Koimbator, and eight pounds of Abyssinian. Bourbon and Sea Island gave no return. The Kusvugal husbandmen's returns were at the rate of forty-eight and a half pounds the acre on their fields of foreign cotton, leaving them six pounds behind their American rivals. From these results Mr. Shaw hoped by 1845 to see Dhárwár cotton hold a high place among Bombay cottons. To meet the ginning difficulty twenty-four ginning wheels or *charkás* and five saw-gins, cleaning 300 to 350 pounds of cotton in a day, were procured, and several gin-houses were opened. In Mr. Shaw's opinion, and this opinion experience has proved correct, New Orleans cotton yields a larger acre outturn than local cotton. New Orleans is also more easily gathered free of dirt than the local cotton. Its covering leaves or calyx are tougher and thicker, and less apt to break and mix with the fibre than the local covering leaves. The local cotton is also more apt to be damaged by falling on the ground. Further the proportion of wool is larger in New Orleans than in the local cotton. In a hundred pounds of New Orleans thirty-three pounds are wool, sixty-six pounds seed, and one pound waste; in a hundred pounds of local cotton twenty-four pounds are wool, seventy-five pounds are seed, and one pound is waste. Except that they were ill-ginned, parcels of the 1843 experimental cotton were favourably noticed by the Bombay Chamber. Mr. Hadow's experiment with Bourbon at Gadag did not pay its cost in the first and second years (1842-43). In the second year (1843) it was under the care of Mr. Hellier, a German, to whom it had been made over by Mr. Hadow. In Mr. Shaw's opinion the result showed that no further experiments should be made with Bourbon. It would never be a success and all experiments with it would only interfere with the efforts to spread the cultivation of New Orleans. Mr. Mercer agreed with Mr. Shaw, and added that the outturn of Bourbon was less than that of the local cotton. Shortly after this Mr. Shaw went to England. He was succeeded by Mr. Goldsmid, who, as well as Mr. Mansfield the first assistant collector, took much interest in the cotton experiments.

In 1844-45, 2749 acres were under American cotton. A second experimental farm of 168 acres, of which 146 were under New Orleans and twenty-two under Broach, was started near Gadag under Mr. Hawley, while Mr. Mercer continued his experiments at Kusvugal. Mr. Hawley met with remarkable success. His New Orleans gave an acre return of 94½ pounds of clean cotton and his Broach of 123½ pounds. Some of the fields would have done credit to the banks of the Mississippi. Mr. Mercer's plants were attacked by field bugs and caterpillars and yielded poorly. The acre return of clean cotton on 150 acres of New Orleans ranged from eighty-one and a half to fourteen and a half pounds. The return on sixteen acres of Broach gave an average of sixty-three pounds, ten acres of Bourbon gave an average of twenty-two pounds, and eleven acres of Abyssinian an average of ten and a half pounds. In this season both Mr. Mercer and Mr. Hawley tried manure. In 1845 the experimental farms were closed on the ground that it was no longer necessary to supply the people with American seed. Twelve saw-gins were at work, seven private and five Government, but to meet the people's wants at least twenty more were required. In 1845-46 the rains

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were disappointing, and instead of 17,000 acres only 11,176 acres were planted with American cotton. In this season the planters were allowed to raise cotton for Government by contract with the landholders. Mr. Mercer paid 4*s.* (Rs. 2) for tillage, 2*s.* (Re. 1) an acre for land rent, and, after paying all other expenses, 7*s.* (Rs. 3½) the acre for carrying the cotton to the ginning house. Mr. Mercer calculated that, at an acre yield of sixty-three pounds of clean cotton, the crop would cost the husbandman 1½*d.* (1 *a.*) the pound. After giving credit for the value of the seed it was found that the crop represented an outlay to the grower of very little over a penny a pound. The whole produce of the district was calculated at 1200 to 1500 bales of American cotton. The growth of American cotton was left entirely to the people. But Government were the only buyers and there were no saw-gins to gin it. The want of saw-gins was the great drawback to the spread of American cotton, as the people would not grow American cotton unless they were sure that they could clean it and sell it. In June of the same year (1845-46) Mr. T. W. Channing, one of the American planters at Kusvugal, brought to the notice of Government that the American saw-gins were not suited to the acclimatized varieties, and that better and cheaper saw-gins might be made in India. He thought that by making them on the spot the price of a saw-gin might be lowered from £35 to £19 16*s.* (Rs. 350-198). A gin made under Mr. Mercer's directions cost only £14 14*s.* (Rs. 147). At a trial made by Captain, the late Sir George Wingate, then superintendent of the revenue survey, the local gin beat the American saw-gin by twenty-five per cent. Mr. Mercer asked for a good European mechanic. Instead of this, and this was probably a better arrangement, the Court of Directors sent out 500 saws the only part of the gin which could not be easily made in Dhárwár. It is in great measure to the arrangements which were then made for cleaning the cotton that Dhárwár owes its special success in the growth of saw-ginned Dhárwár.

In 1846-47, for the first time, local dealers bought American cotton on their own account, and at rates twenty per cent over local cotton. Mr. Hawley soon after resigned and was succeeded by Mr. Blount, also an American, who had come from Khándesh. Mr. Mercer left at the end of 1846. About the same time the tests made by Lancashire spinners on Government shipments of Dhárwár New Orleans showed a loss of twenty-one pounds on 332 pounds of Dhárwár New Orleans before carding, compared with a loss of 38¾ pounds on an equal quantity of common Surats. After carding the losses on similar quantities were sixteen pounds of Dhárwár New Orleans and 28⅞ pounds of Surats. When spun fifty pounds of ordinary American New Orleans showed a loss of 17½ per cent and an outturn of 41¼ pounds of yarn, while the same quantity of Dhárwár New Orleans turned out 42½ pounds of yarn with a loss of fifteen per cent. The yarn of Dhárwár New Orleans was pronounced equal to yarn made from ordinary American New Orleans. In May 1846 Mr. Mansfield, then acting Collector, recommended Government to cease holding out special inducements for the growth of American cotton. The people were willing to sow it to any extent, provided Government guaranteed them a sale. After another year, if the merchants did not step in

and help in creating a demand, he did not see why Government should foster the production of an article which had no fixed market value. In a second letter about the end of the year, Mr. Mansfield urged that the uncertainty of the price of Dhárwár New Orleans cotton in Bombay was the doubtful point in the experiment. Until something was done to ensure a demand for the cotton, the burden of buying the entire crop would continue to fall on Government. He thought that part of the Dhárwár American crop should be offered for sale in Bombay. Government approved of selling some of the cotton in Bombay, but were unable to offer it for sale as the Court of Directors found that the opinion had lately spread in England that the recent shipments of good cotton were pet packages from cotton grown as a garden crop. The Court were therefore anxious to have as much cotton as possible to show that the better class of cotton could be grown in sufficient quantities for trade purposes. One bale was left in Bombay for the inspection of merchants. Towards the close of the year Mr. Townsend, the Revenue Commissioner, represented the results of the Dhárwár cotton experiments as encouraging. The weak point was the want of a suitable provision for ginning. Government agreed with Mr. Townsend that Mr. Mercer's efforts to establish American cotton had been to a great extent successful. In 1847-48 20,500 acres were under New Orleans cotton. At first an outturn of over 700 tons (2000 *khandis*) was expected; later on it was found that the unfavourableness of the season would reduce the outturn by one-third. Twenty-nine saw-gins were at work in the district and many more were wanted. About this time the American planters, brought by Captain Bayles, expressed the opinion that New Orleans cotton would succeed only in districts which like Dhárwár shared in the two monsoons. Early in 1848 Mr. Goldfinch, the first assistant collector, discovered that in many villages the persuasion of the village authorities to get the landholders to grow American cotton had differed little from compulsion. Mr. Bell, the Collector, satisfied himself that Mr. Goldfinch was correct. Persuasion was stopped and the area of American cotton fell from 20,500 to 3350 acres. The people had grown American cotton because they had been ordered to grow it. Still in parts of the district they would grow New Orleans from choice, if only they could be sure of a market and had less trouble in getting it ginned. In this year (1848-49) the New Orleans crop was excellent, upwards of ninety pounds of clean cotton an acre, and it yielded such admirable seed that the character of the cotton was permanently improved.

In 1849-50 over 15,500 acres or five times as much as in the year before were under New Orleans. The increase was due to a better understanding with the people and better ginning arrangements. 1849-50 was one of the best New Orleans seasons. It was a bumper crop, and very much more of it than in any former season was ginned in the husbandmen's gins, which had risen from five to sixty-two. Still, either because there were still not enough gins or because the gins were badly worked, the ginned cotton was unsatisfactory. The unsatisfactory state of the Dhárwár cotton was not confined to the American cotton. The local cotton was at

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this time the dirtiest and the most fraudulently packed cotton that came to Bombay. Up to 1849, apart from what the sales of the cotton realised, Government had spent £20,000 (Rs. 2,00,000) on cotton experiments in Dhárwár. In 1850-51 over 31,000 acres were under New Orleans, Shiggaon, now Bankápur, showing nearly 13,000 acres or an increase of 200 per cent over the previous season. In the Liverpool market this cotton fetched 3½*d.* the pound. In 1851-52 over 42,600 acres were under New Orleans, of which 17,000 acres were in Bankápur and 700 acres in estate or *jágir* lands. In this year Government gave up buying cotton. By this time Dhárwár New Orleans had gained so high a name in England, that the agents of Manchester firms in Bombay were ordered to make large purchases, and, in 1851, Dhárwár New Orleans was sold in Dhárwár at 3*d.* a pound (Rs. 100 a *khandi*). In 1852-53 a difficulty regarding the repair of the saw-gins reduced the acreage to a little over 28,000 acres, exclusive of nearly 8800 in estate or *jágir* lands. Great exertions were made at the Dhárwár ginning factory to meet the want of gins, and they were so far successful that in the next year 184 gins were in use, and the area rose to 41,403 acres, of which nearly 10,000 were in estate lands. This success was the more satisfactory that in this year Government had withdrawn from ginning as well as from buying. In 1853-54, 41,403 acres were under New Orleans and 252,006 acres under local cotton. In 1854-55 upwards of 63,000 acres in Government lands and more than 18,250 in estate land were planted with New Orleans. During these years the area under local cotton varied from about 223,000 acres in 1850-51 to 210,260 acres in 1854-55. During the same years the price for a *khandi* of 784 pounds of New Orleans varied from £7 10*s.* to £9 10*s.* (Rs. 75-95), and of local Dhárwár from £6 to £8 (Rs. 60-80), that is an average of £1 10*s.* (Rs. 15) or 18¾ to 25 per cent in favour of New Orleans. Compared with what he had seen between 1843 and 1850, in 1854 Captain, now General, Anderson noticed a marked improvement and extension in cultivation. The fields were kept carefully cleaned and manuring had become so common, that in some parts crops were grown to be ploughed in as manure. Some Bankápur cotton growers owned to occasionally getting 500 pounds of seed cotton to the acre, and 300 to 390 pounds was not unusual. During the thirteen years ending 1853-54 the mean price of a bundle or *nug* of 300 pounds of clean cotton was £1 19*s.* 3*d.* (Rs. 19⅝) in Navalgund and £2 10*s.* (Rs. 25) in fifteen other cotton centres. At the same time the Government rental had been reduced to an acre average of 9¾*d.* In 1855-56 defective ginning arrangements reduced the area of New Orleans cotton to 50,803 in British and 15,711 acres in estate lands. In the same year 202,843 acres were under local cotton. In 1856-57, 108,207 acres were under American and 196,931 under local cotton.

In 1857-58 the area under New Orleans was 130,880 acres and the area under local cotton 252,850 acres. In this year several experiments were made with Egyptian cotton seed. The Collector found the plants grow remarkably well. They were much larger and finer bushes than the New Orleans, but the pods rarely matured and were very liable to be destroyed by insects.

An experiment made with watered Egyptian failed. Messrs. Brice & Company, who since 1854 had opened a trade agency at Dhárwár also made experiments with Egyptian and failed. They inclined to attribute their want of success to the exceptional lateness of the rains, which did not set in till the middle of October and then lasted for a month. At the beginning of March the plants were full of pods and promised a rich crop; but the dry winds of March and April were too severe a trial, and the pods fell without yielding cotton. The Collector did not agree with Messrs. Brice & Company that the failure had been due to untimely rainfall. In his opinion Egyptian cotton was not suited to the district. The weather described by Messrs. Brice & Company had done little harm, either to the New Orleans or to the local crop. The details of Messrs. Brice & Company's experiments show that one at Gadag failed entirely; the plants came up and then died away. At Bankápur the experiment promised well to the end of February; but by the middle of April 6800 plants gave only twenty-six pounds of seed cotton on first and second pickings. They yielded no more cotton, and animals were allowed to graze on the plants. At Hubli 8124 plants gave 106 pounds of seed cotton, which, on being ginned, gave thirty-two pounds of wool, seventy-one pounds of seed, and three pounds of waste. These experiments with Egyptian seed were on a fairly large scale as they covered 169½ acres including sowings in five sub-divisions and 5¼ acres in Sávanur. The result was a mean acre return of about twelve pounds of clean cotton. But as the cotton was valuable, its estimated price reduced the computed loss on the experiment to about 10½*d.* (7 *as.*) an acre. Up to May 1857 cotton improvements in Dhárwár had cost Government £42,463 12*s.* (Rs. 4,24,636). Some of this large outlay was recovered in the sale of consignments of Government cotton in England. In 1858-59 the cotton area showed an increase of 4000 acres in Government lands, and from some unexplained cause a decrease of 10,000 in *jágir* lands. The whole area under New Orleans was 124,752 acres, compared with 214,993 acres under local cotton. The experiments to introduce Egyptian cotton were continued; 261 acres were planted in seven sub-divisions. The result was again unsuccessful, the mean acre yield of ginned cotton being barely fifteen pounds and the net acre loss on tillage nearly 1*s.* 9*d.* (14 *as.*). As in the previous year, the plants grew vigorously and bore quantities of bolls; but most of the bolls never ripened. The assistant collector, who managed much of the experiment, stated that he had not seen one single instance of success with Egyptian cotton. Samples of the small Egyptian outturn together with samples of ordinary Dhárwár New Orleans were sent to the Bombay Chamber of Commerce. The Egyptian was valued at 1*s.* the pound and the New Orleans at 6*d.* In 1859 the Dhárwár cotton growers were very flourishing, mainly owing to the handsome profits which American cotton yielded. In 1859-60 increased ginning facilities raised the area under New Orleans by fifty per cent, the total area being 191,282 acres. At the same time the area under local cotton was 230,665 acres. In this year fifty-six gins were issued from the Dhárwár ginning factory. A third experiment with Egyptian ended much like the former

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attempts, and the Collector, Mr. Goldfinch, considered the variety unsuited to the soil. An English merchant, Mr. Brook, made fairly large experiments with Egyptian and Egyptian Sea Island. Mr. Brook was of opinion that these cottons would succeed if they were sown much earlier than the local cotton. This theory was tested. The result showed that Mr. Brook was to a certain extent correct. Where good seed was used, the plants throve amazingly, and so far as size and appearance went, beat all other varieties. They went too much to wood and leaf, but still seemed likely to yield largely. They matured much sooner than the other cotton. The crop was ripe early in October, when a heavy burst of rain almost yearly falls. The rain fell and the cotton was spoiled. What was picked was weak in staple. This and their own experience so disappointed the landholders, that they refused to try any more Egyptian at their own risk. In 1860 the practice of mixing local and New Orleans brought New Orleans into disrepute, and it lost much of its value. The Bombay Chamber of Commerce thought the falling off was due to crossing. Further inquiry showed that this was a mistake. Dr. Forbes' conclusions were more correct. He thought the decline was due to wilful adulteration, and to the cultivation of local and American in the same field. Both kinds were picked and ginned together, and as the local cotton was cut to pieces in the saw gins, the thorough mixture injured the whole. So greatly did the New Orleans suffer that during the ten years ending 1860 its value had fallen from seven-eighths of a penny above to a quarter of a penny a pound below Broach. That this fall in value was not due to a deterioration in the New Orleans seed was proved by growing two packages, one from fresh New Orleans seed and one from ten years old, that is ten times cropped, New Orleans. The Bombay Chamber valued the fresh seed cotton at $6\frac{1}{2}d.$ and the old seed cotton at $6\frac{1}{4}d.$ a pound. The only difference was that the staple of the old cotton was slightly weaker. In 1860-61, 191,026 acres were under American and 234,452 acres were under local cotton. Fifty-five new gins were issued, and gins were still in great demand. In 1861-62 New Orleans rose to 214,310 and local cotton fell to 200,491 acres, and forty-two more gins were sold, making a total of 884 working gins. In 1861 besides proving that the decline in the value of New Orleans was solely due to mixing, Dr. Forbes, with the help of the district officers, succeeded in getting the people to root local plants out of New Orleans fields. The result was a marked advance in the value of the 1861 New Orleans. In 1862 the mixing was again as bad as or worse than ever. In 1862 Dr. Forbes with Mr. Heywood a leading Manchester merchant, went to see a gin-house. On entering the courtyard, which was enclosed by a high wall, they saw on one side a large heap of trashy local cotton, and near it another heap of about the same bulk of fair American seed cotton. The space in front of the gin-house was covered with a mixture of the two heaps spread in the sun to dry, and on this mixture the gins were at work. Dr. Forbes found that the husbandmen blamed the ginners for the mixed cultivation. The ginners, they said, returned them mixed seed, and this they had to sow.

The ginners said the fault was with the husbandmen who gave them mixed seed cotton to gin. The charge was generally brought home to the ginners. Dr. Forbes found that in the Hubli saw-gins the American and local cottons were being mixed. Mr. Everitt, an English merchant at Dhárwár, found mixed ginning spreading so rapidly that he had to close his Dhárwár business. Dr. Forbes wrote that the American was now more than half local, and that too of the worst description. Mr. Gordon, the Collector, said that he and his assistants were powerless to prevent the mixing, and that it must do great mischief to the cotton trade. Mr. Hart, the Revenue Commissioner, agreed with Mr. Gordon that this mixing should be stopped and that passing an Act was the only way to stop it. Dr. Forbes was satisfied that fear of the law was the only way of stopping the mixing. The owners of gin factories were rapidly growing rich. He had orders for 591 gins worth £17,800 (Rs. 1,78,000) from people who a few years before could not buy a few gins worth £3 or £4 (Rs. 30-40). As Dr. Forbes' opinion was upheld by almost all the officers who were consulted, Government appointed a Commission to inquire into cotton adulteration.[1] Three members of the Commission, Messrs. Forbes Scott and Hannay, came to the Bombay Karnátak to inquire into the state of the Dhárwár cotton trade. They found that, during the season in which the inquiries were made, little or no local or American cotton had been shipped clean or unmixed. Besides the mixing of different varieties of cotton the dealers admitted that their cotton was mixed with seeds and other rubbish, and that it compared badly with the exports of former years. Many of the local dealers were anxious that the trade should be regulated by law and placed under inspection. In their report the Commissioners stated that the evils of the Dhárwár cotton trade were beyond usual remedies, and affected not only local but general interests. Nothing but the energetic action of Government could check so widespread an evil. Existing laws were insufficient, a fresh Act was required. With their report they submitted the draft of a Cotton Frauds Bill, which had been prepared by Mr. Scott one of the Commissioners, and which had been altered and completed in accordance with the opinion of the Commissioners. This measure, with some amendments, was brought before the Legislative Council early in 1863. It passed in April 1863, and became law in July of the same year as the Bombay Cotton Frauds Act IX. of 1863. The first cotton inspector appointed for Dhárwár was Captain, now Colonel, R. Hassard, of the Bombay Staff Corps, who had already received charge of the Dhárwár factory from Dr. Forbes, on his appointment as Cotton Commissioner. Captain Hassard's duties of superintendent at a chief and two branch ginning factories left him little time for inspection. The American war had begun and the great rise in the value of cotton enabled even mixed and adulterated cotton to find a market. In 1862-63, exclusive of the cotton area in estate villages,

[1] The members of the Commission were Messrs. G. Inverarity, M. H. Scott, R. Hannay, R. McIlwraith, G. F. Forbes, and C. Forjett. Three of the members were nominated by the Bombay Chamber of Commerce.

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363,174 acres were under American cotton, and 207,063 acres under local cotton, and in 1863-64, 323,535 acres were under American and 203,626 acres under local cotton. The local price of Dhárwár New Orleans rose from £14 (Rs. 140) the *khandi* in 1860 to £38 (Rs. 380) in 1863, and to £46 10*s.* (Rs. 465) in 1864, and every available patch was planted with cotton. In 1864-65 a bad season reduced the American cotton area to 280,230 acres and the local cotton area to 185,374 acres. Growers and dealers tried to supplement their deficient crop by mixing and false packing, and, as most of the inspector's time was again devoted to the factories, the people began to think that the Frauds Act was not to be enforced. The offices of superintendent of the factory and of inspector were separated. Early in 1865 Mr. G. Blackwell was appointed inspector. He began a vigorous inquiry, and though several of the prosecutions failed from want of proof of fraudulent intent, the dread of conviction greatly reduced the amount of adulteration. Efforts were also made to induce the landholders to give up mixing the two varieties of seed in the same field, and to pay more attention to the choice of good large seed. In 1865-66, there was a further fall in the area, to 160,046 acres under local and 261,943 acres under American cotton. This fall was probably due to the scarcity of fodder and grain caused by the failure of rain in 1864-65. In 1865-66 the rainfall was again far from favourable, and the outturn of most crops was poor. The inspector found it very difficult to prove the mixing at the gins fraudulent under the provisions of the Act. In this year large supplies of fresh seed were distributed, and did much to improve the quality of the New Orleans cotton.

In 1866-67 the area under American rose to 304,688 acres and under local cotton to 161,750 acres. Under the influence of the cotton inspectors, frauds and dirt-mixings were greatly checked. Still, in the opinion of Mr. Bulkley the inspector-in-chief of cotton, the working of the Act had brought to light a flaw in the provisions regarding fraudulent mixing. To be fraudulent, mixing must take place in cotton either offered for sale or offered for pressing. There were no presses in Dhárwár and the cotton was sold not in Dhárwár but in Bombay. So the inspector might see in a ginning yard a heap of local, a heap of American, and a third heap of seed to be added as a make-weight and yet fail to secure a conviction. One effect of the cotton famine in Lancashire caused by the American war was to give fresh importance to the question of improving the supply of Indian cotton. It was felt that no considerable results could be looked for unless specially trained men were employed and set apart for the special duty of improving cotton. In 1866-67 Mr. W. Shearer was sent out by the Secretary of State to undertake the charge of cotton experiments. In 1867-68 the area under American cotton fell to 300,399 acres and the area under local cotton rose to 181,485 acres. Mr. Shearer began his experiments on twelve acres of land near Dhárwár which were leased for five years. He carefully planted two kinds of local cotton, and the result promised fairly well. But he was ordered to Gujarát before the crop was picked and the cotton was sold before his return

and no record kept. Mr. Blackwell the inspector found a great deal of false packing. He tried to persuade merchants to aid him in bringing the offenders to punishment, but failed, as the merchants though willing were afraid to offend the dealers. In 1868-69 the area under American cotton rose to 317,310 acres and under local cotton to 194,586 acres. Though both crops suffered from blight the outturn was fair. With the revival of American supplies the price of cotton fell. To make good the loss in price, the dealers weighted the cotton by adding dust and other refuse. These fraudulent mixers were fairly safe as with a little care they could destroy the cotton without breaking the letter of the law. Of several prosecutions, all of which were aggravated cases clearly within the spirit of the law, only one was successful. Mr. Shearer's farm of twelve acres near Dhárwár was given up and a larger farm of thirty acres was started at Kusvugal near Hubli. In 1868 two more cotton experiment superintendents, Messrs. Milne and Strachan, came from England and were placed for some time under Mr. Shearer. Mr. Shearer's experiments included sowings of Dhárwár American and local, and of Broach, Tinnevelli, Tanjor, and Koimbator. Except the local Dhárwár none of these yielded a good outturn.

In 1869-70 the area under American rose to 425,099 and of local to 222,116 acres. This great increase in American was mainly due to increased facilities for repairing the cleaning machinery. The sowing was late on account of heavy early rains, and the crop was much hurt by blight when the plants were nearly mature. About fifty tons of the best acclimatized seed were distributed in Karajgi, Navalgund, Ránebennur, and Ron, and about a ton of fresh American seed was distributed by Mr. Shearer. The acclimatized seed was willingly sown, but the people were afraid to risk the fresh American. Fresh American seed sown by Mr. Shearer throve well. Two fraud cases were tried; but both failed. Mr. Shearer worked this year on a much larger scale than before. He had farms of 198 acres in Bankápur, Kusvúgal, and Navalgund; and planted several varieties of cotton. The result was disappointing mainly owing to the badness of the season. In these experiments the late sown plants throve better than those sown earlier. The object in dividing the experiments was to secure a fair average of soil and climate. In addition to this Mr. Shearer set apart a small piece of land close to his house at Kusvugal, as a nursery to study the habits of the different cotton plants, and to test the theories of crossing. In 1870-71 the area under American fell to 335,297 and under local to 195,304 acres. Up to the time of picking, the season was fair, then heavy rain fell and damaged the ripe crop. Frauds were rife, but there was no successful prosecution; and great complaints were made of the state of the saw-gins. Mr. Shearer continued his experiments in the same sub-divisions, but on fresh land. The land was ploughed with English ploughs and was afterwards stirred with an English grubber. He used both patent and native manure, but failed to discover any difference in the yield of cotton crops on manured land, and on unmanured land. These experiments were more successful than any of his former ones; the largest acre yield of clean cotton was 129 pounds. The people were

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so much pleased with the result of the sowing that they applied for seed. In 1871-72 the area under American cotton fell to 315,387 acres and the area under local cotton rose to 203,191. This season Mr. Shearer's experiments were limited to 110 acres, eighty at Kusvugal and thirty at Navalgund. Between excessive rain and cutting winds the season was unfavourable. At Kusvugal the selected seed American cotton was sown in three fields. Sowing was begun on the first and completed on the tenth of September. The crop was not large, the acre outturn of clean cotton averaging sixty-one pounds. At Navalgund two fields of fourteen and ten acres planted with local cotton yielded an acre outturn of sixty-two and twenty-one pounds of clean cotton, the remaining six acres were planted with acclimatized Broach which returned an acre yield of fifty-seven pounds of clean cotton. At Kusvugal Mr. Shearer did the greater part of his work with English tools, with the view of making native farmers acquainted with their use. The English tools did their work better than the native tools; and Mr. Shearer always offered the people such tools as he could spare. During his whole stay he was only thrice asked for their use. The native tools were effective when the under-soil was moist from rain, and it was only with moist under-soil that the cultivator worked. In 1872-73 the area under American cotton fell to 195,809 acres, and the area under local cotton rose to 318,448. Fraud, both in ginning and in packing was rife; of fourteen prosecutions eight were successful. Mr. Robertson the Collector thought that the Cotton Frauds Act was weak and that the Dhárwár trade required a much more stringent law. During 1872-73 a difficulty regarding continuing Mr. Shearer's pay out of the Cotton Improvement Funds stopped his experiments and seriously interfered with his arrangements. In this year the question was raised whether it was worth while trying to keep up the supply of American cotton. Would it not be as well to have the whole area under the local cotton? Many of the native dealers were of opinion that the local cotton could never be as valuable as the American cotton; one reason why so much local cotton was grown was that its seeds were a valuable cattle food. The cotton inspector contended that if the whole cotton area was given to local cotton there would be serious difficulty in getting it ginned. The markets for the two crops were distinct, and this division by reducing supplies tended to keep up the value of both. Finally the American was a more valuable crop than the local crop. The yield was larger, the price was higher, and the proportion of clean cotton to gross outturn was greater. Mr. Robertson endorsed this opinion: he thought the importance of the American variety could not be overrated.

In 1873-74 the area under American rose to 215,325 acres and the area under local fell to 268,169. The outturn was fair. Mr. Shearer gathered about 16,000 pounds of selected American seed which the Collector Mr. Robertson distributed in Gadag, Hubli, Navalgund, and Ron. It was arranged that similar distributions should be made every year. The system followed was to gather good seed from the best tracts and distribute it in the parts of the district where the Dhárwár-American had deteriorated. The plan was

excellent except that it was on too small a scale. Fraud was very troublesome and of twelve prosecutions only five succeeded. All the European merchants of the district joined with the inspector in pleading for an Act with stronger provisions, and in this they had the support of the Collector Mr. Robertson. In 1873 in the Government farm which was started near the villages of Lakmanhali and Navalur about five miles south of Dhárwár, the land was divided into seven plots and planted with American and local cotton. In the first season the acre yield of the American cotton varied from sixteen to seventy-five pounds of clean cotton, and of the local cotton from seventy to 154 pounds. In 1874-75 the area under American rose to 234,341 acres and the area under local cotton fell to 221,343 acres. Fraud was very rife, but by the exertions of the inspector Mr. Walton of thirty-six prosecutions, thirty-two were successful. Some of this season's cotton was ginned in the steam gins which had been lately started by the Kárwár company at Hubli. In this year (1874) Government appointed a Commission to inquire into the necessity for continuing the special law to suppress cotton frauds.[1] The majority of the Commission, after collecting a large amount of evidence, were of opinion that though it was not advisable to annul the Act it was advisable to place it in abeyance for a time. When the matter was referred to the Secretary of State the Bombay Government were directed to prepare a fresh Act with the object of remedying the defects of the existing measure. Heavy and unseasonable rain made 1874-75 an unsuccessful cotton season at the Government farm. The acre yield of local Dhárwár and Broach was only forty-five pounds of clean cotton. The fresh American seed sprouted well, but soon after died. The acclimatized American promised well but suffered from blight; the acre outturn was fifty-seven pounds of clean cotton. To test the theory of the crossing of the two varieties one plot was sown with a mixture of local and American seed. The plot promised well, but about two-thirds of the bolls were spoiled by blight. A plot of New Orleans sown at the end of August yielded only thirty-five pounds of clean cotton the acre. Government were disappointed with the results; such repeated failures year after year must end in the closing of the farm.

In 1875-76 the area under American rose to 336,235 and under local cotton to 232,630 acres. A steam-ginning factory was opened at Gadag and much cotton was ginned in steam-gins. In consequence of the last year's successful prosecutions there was a considerable improvement in both varieties of Dhárwár cotton, though some badly adulterated cotton, ginned and packed in the Nizám's country, injured the name of Dhárwár cotton. Of fifty-eight prosecutions fifty-three were successful, but of the convictions two were afterwards reversed on appeal to the High Court in Bombay. The cotton experiments on the Government farm were

[1] The members of the 1874 Commission were the Honourable A. Rogers, President, and the Honourable Messrs. E. W. Ravenscroft and Náráyan Vásudev, and Messrs. H. P. LeMesurier and E. M. Fogo, members.

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fairly successful. Owing to the failure of the usual October and November rain the cotton crop was nowhere good and this failure of rain was accompanied by so blighting an east wind that Mr. Shearer thought it must be poisonous. The acre yield of clean American cotton in well prepared good black soil was thirty-four pounds. The acre outturn of clean local cotton in equally good soil was only twenty pounds. One plot of ground was sown with American cotton with sunflowers scattered here and there. The cotton plants grew well till November and were then caught by blight. The superintendent tried every means, including watering, to save the crop; with all his efforts he only succeeded in keeping the leaves a little greener than those of the plants in the neighbouring fields. Another three-acre plot was divided between selected American seed and freshly imported American seed. The land was well manured with slaughter-house refuse and poudrette in separate parts, but with no variety in result. The crop was attacked by blight and the acre outturn was nineteen pounds of clean cotton. A quantity of dissolved Peruvian guano, costing in Bombay £17 10*s.* (Rs. 175) a ton, was freely applied to cotton, but apparently without any improving effect. The guano was applied at the rate of three hundredweights the acre on a field of local cotton. So long as rain lasted the guanoed patch grew specially freely. When the dry weather set in this difference disappeared, and the outturn proved no larger than that of the neighbouring fields. The saw-gins were falling into disrepair and their state was unsatisfactory.

In the famine year of 1876-77 the area under American cotton fell to 44,024 and under local cotton to 99,830 acres or little more than one-fourth of the average area of the five previous years. The large number of convictions in the previous year was followed by a great improvement in the state of the cotton. The dealers never remembered such clean cotton. At the Navalur farm Mr. Shearer sowed American fresh and acclimatized, and selected Broach. In addition to the experiments at the Government farm Messrs. Robertson Brothers & Co. planted about fifteen acres with Hinganghát seed in three fields of about five acres each. Their aim was to try Hinganghát seed both for early and for late sowing. The first field had no manure and was sown about the 15th of August; the second field had twenty carts of common village manure and was sown about the 20th August; and the third field had thirty carts of common village manure and was sown about the 25th of August. Messrs. Robertson & Co. arranged with the landholders to make good whatever the outturn of the Hinganghát fields fell short of the outturn of neighbouring fields of local or of American-Dhárwár. At the same time any return over that of neighbouring fields was to go to the landholder. The complete failure of the late rains made these arrangements useless. So complete was the failure of the cotton crop that Messrs. Chrystal & Co. in Gadag did not press a single bale. Of four prosecutions two were successful. The crop was very small and what came to market was clean. In 1877-78 the area under American rose to 128,277 acres and the area under local cotton to 277,300 acres. There was no local case of mixing or false

packing, but much seriously adulterated and falsely packed cotton came from the Nizám's country and was sold on the coast under the name of Dhárwár saw-ginned cotton. Messrs. Robertson & Co. continued their experiments in Hinganghát. The seed was sown in July and in November the plants with flowers and some with bolls promised well. Heavy rains in December spoiled the crop reducing the outturn of nineteen acres to three bales of clean cotton. One of the chief objects of Messrs. Robertson & Co.'s experiments was to introduce an early cotton into Dhárwár. The result was disappointing. The plants sown in July did not ripen earlier than the plants sown in September. It seemed as if the plants were unable to ripen so long as the ground remained damp and the weather continued cloudy. Mr. Campbell, the manager of the Kárwár Cotton Company, made an experiment with Egyptian Bunnia cotton. Mr. Campbell divided his field into two parts: one which he worked in the same way as the people grew American cotton, and the other part which he watered. The seed was sown on the first of September, the first watering was given on the 17th of November, and watering was continued at intervals until the beginning of May. Mr. Campbell found no difference between the watered plants and the unwatered plants. The number of watered bolls was small, and the staple was good. But the colour was so bad that it looked as if it had been stained by damp. Five hundred pounds of fresh American seed were received from Government for distribution. In 1878-79 the area under American cotton rose to 246,210 acres and under local cotton fell to 233,280 acres. Of eight cotton fraud prosecutions six were successful. As in former years the passing as Dhárwár American of cotton adulterated in neighbouring states was a serious evil. In September 1879 the Government of India recommended that all special legislation for the suppression of cotton frauds should cease. The Secretary of State did not agree with the view held by the Government of India. In 1879-80 there was a marked fall in American and rise in local cotton. The American area fell to 141,726 acres and the local area rose to 331,465 acres. On the 4th of March 1880, the Secretary of State sanctioned the proposals that had been made in 1879 by the Government of India, and desired the Bombay Government to do away with the special cotton fraud prevention establishment. According to Mr. Walton, the opinion of the local European agents and native merchants was opposed to the giving up of Government efforts to check fraud. According to Mr. P. Chrystal, a Bombay merchant who is well acquainted with the Belgaum and Dhárwár cotton trade, the Bombay dealers and merchants in American Dhárwár and Kumta cotton think (1883) that the Cotton Frauds Act failed to stop adulteration in the Bombay Karnátak. Mr. Chrystal thinks that since the Act has been stopped, there has been no noticeable increase in adulteration. The American Dhárwár has declined in staple and lost its silkiness, but this he thinks is due not to more mixing but to deterioration in the American seed. In 1880-81 the area under American cotton fell to 77,121, and the area under local cotton rose to 439,251. In 1881-82 the area under American cotton rose to 138,790, and the area under local cotton fell to 395,396 acres.